

Reissued by Arrow Books 2010

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First published in Great Britain in 1997 by Arrow Books

The Random House Group Limited  
20 Vauxhall Bridge Road, London, SW1V 2SA

[www.rbooks.co.uk](http://www.rbooks.co.uk)

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The Random House Group Limited Reg. No. 954009

A CIP catalogue record for this book  
is available from the British Library

ISBN 9780099237624

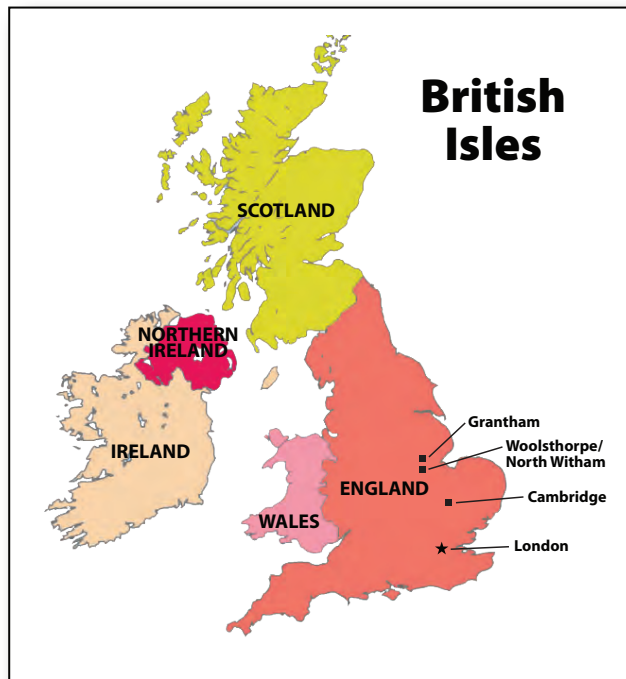
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Typeset by SX Composing DTP, Rayleigh, Essex

Printed and bound in Great Britain by  
CPI Cox & Wyman, Reading, RG1 8EX

Excerpts from:  
**Newton & Gravity** (Pages 7-22)  
by Paul Strathern

**General Note:** Paul Strathern is a British author. There are some grammatical and spelling differences between “British” English and “American” English. I did make an effort to “Americanize” the spelling. There are many challenging vocabulary words in these excerpts. These words are underlined. As part of your KWL assignment, look-up all of the words. The words are summarized in the back of this packet. Submit the back page with your KWL.



## INTRODUCTION

A good case can be made for Newton being the finest mind humanity has yet produced. Shakespeare used language as no other, Napoleon used personality as no other - but no one has ever extended the limits of human understanding quite so drastically as Newton.

His work represents an evolutionary advance in our thinking - one giant leap for mankind. Long before we landed on the moon (or even considered doing so) Newton's mathematics paved the way for such a feat. Before Newton, the moon was part of the heavens, subject to unknown heavenly laws of its own. After him it became a satellite of earth, kept in orbit by the planet's gravitational pull. Humanity had its first glimpse of how the entire universe worked. But the discovery of universal gravity was only the most major of Newton's many major discoveries. The concept of force, calculus, the nature of light, the theory of mechanics, the binomial series, Newton's method in numerical analysis - the list goes on and on. More units, and scientific and mathematical entities, are named

after Newton than after any other scientist. The newton (the SI, or internationally agreed, unit of force), Newtonian fluid, Newton's formula (for lenses), Newton's rings (in optics), the Newton quotient (in differentiation) and many more - each the direct result of his work.

Yet all this was only possible because Newton arrived at the right moment in history. Just as Dante could only have written his *Divine Comedy* within the rigid all-embracing hierarchy of the Middle Ages, so Newton could only have made his discoveries after Copernicus and Galileo had freed the scientific mind from those same rigidities. As Newton himself confessed: 'If I have seen a little farther than others it is because I have stood on the shoulders of giants'.

The chains of medieval restraint had fallen away, and the door of human knowledge had opened upon a new world. In Newton's view, he had achieved little: 'I seem to have been only like a boy playing on the seashore, and diverting myself in now and then finding a smoother pebble or a prettier shell than ordinary, whilst the great ocean of truth lay all undiscovered before me'. The modesty exhibited here is of course dwarfed by the oceanic vision - which he alone was in a position to see. An implication that Newton may well have intended. He was not by nature modest.

So what kind of man was the possessor of the greatest intellect in history? In general, Newton's contemporaries came to regard him much as we in the 20th century regarded Einstein. A tame eccentric, member of a rare protected species, the absent-minded genius of unquestionable moral stature: a distant but faintly loveable figure - vouchsafed enormous gravitas by the sheer weight of his achievements. In his time, Newton was the solitary scholar chosen by his peers as MP for Cambridge University, the revered president of the Royal Society re-elected unopposed year after year, the Master of the Royal Mint feared and hated by the counterfeiters of the London underworld. As is so often the case, it was the common people who recognized the man for what he was. For beneath the austere public façade lay a deeply disturbed and vindictive personality, harbouring his own illicit secrets.

## CHILDHOOD YEARS

Isaac Newton was born on Christmas day 1642, in the manor house at the hamlet of Woolsthorpe in Lincolnshire [UK]. By coincidence his great scientific predecessor Galileo had died earlier in the same year.

Nowhere in the Newton family tree is there any sign of exceptional predecessors. His father, also Isaac Newton, was a prospering yeoman who could not even sign his name. 'A wild, extravagant, weak man,' according to his family, he died three months before the birth of his son. His mother was the daughter of an impecunious local gentleman, and was generally regarded as a hard-working, frugal woman.



Isaac was born prematurely, and was 'so little they could fit him into a quart pot'. He was not expected to survive the day of his birth. Having never known his father, young Isaac was to 'lose' his mother when he was just 18 months old. In 1644 Hannah Newton married the 63-year-old Barnabas Smith, a well-off local minister, and went to live in the village of North Witham. Young Isaac was left behind, to be looked after by his grandmother.

Newton never forgot this traumatic event, and its effect left an indelible imprint on his character. His adult life was to be marred by uncontrollable rages, paranoid vindictiveness and occasional mental instability. He loved his mother, but she had abandoned him. He couldn't bring himself to hate her, but heaven help anyone who presented a legitimate target on which he could vent his repressed inner fury.

In fact, North Witham was only a couple of miles up the valley. Young Isaac could even see its church tower across the fields from the hill above his home. But in reality it remained a world away. His true father was 'in heaven', and his mother withdrawn to the limits of his childhood world. In adult life Newton was to devote himself to long and profound speculation about distant heavenly bodies and the nature of their attraction to one another. Not surprisingly, psychologists have seen more than unalloyed coincidence at work here.

In the year of his birth the behavior of Charles I and his belief in 'the divine right of kings' finally drove the Parliamentarians to challenge his rule. The ensuing Civil War raged all over England during the first six years of Newton's life, ending in victory for the Parliamentarians and the execution of Charles I in 1649. Throughout the Civil War sporadic fighting and house-burning took place in Lincolnshire. Newton and other local land owning families were inclined to support the king, but not to the extent of taking up arms.

The Parliamentary victory - the first successful revolution in Europe - saw the establishment of the Commonwealth, followed by post-revolutionary excesses such as have now become the norm. A repressive Puritanism was enforced. All dancing and displays of public merriment were banned, and even Christmas became a day of prayer rather than pudding-eating. Yet here again the farming families of Lincolnshire were hardly affected. They had long lived austere God-fearing lives, with the emphasis on Bible reading and the shockingness of sex. Young Isaac grew up in a habitually puritan household, and absorbed puritan habits as a matter of course. He learned to consult the Bible to discover the wishes of God the father, a habit he was to retain throughout his life.



But God the Father was not only God in heaven, he was also father in heaven. In the ever-booming field of Newtonian psychological studies, most are agreed that Newton was driven by a strong unconscious need to know his father. He knew from his faith that God the father had made the universe, leaving certain clues as to its ultimate nature and His ultimate intentions.

Throughout his life Newton was driven to search obsessively for these clues - in the two appropriate fields. He was to devote just as much of his time to pursuing biblical and religious studies, as he was to the pursuit of scientific truth. And to the end, he was convinced that his religious work would have the most lasting value. For once, the facts appear to be as mad as the psychology.

When Newton was 10, the Reverend Barnabas Smith died and Isaac's mother returned home to Woolsthorpe a comparatively rich woman. Newton's prayers had been answered. There followed two years of curious bliss, tempered by the common-sense reality of his mother, and the additional presence of a half-brother and two half-sisters. But Isaac was the oldest, and Hannah seems to a certain extent to have relied upon him. Before Isaac had even reached puberty he had become 'the man of the family' in his mother's eyes. The basic self-belief engendered by this precocious motherly recognition was never to desert him in his intellectual endeavours, even when the man himself was beset by maddening anxieties.

At the age of 12, Newton went to the grammar school in Grantham, which was 10 miles away. Here he took lodgings with Mr. Clark the apothecary, whose house was on the High Street beside the George Inn. At school his studies consisted almost entirely of Latin and ancient greek. Mathematics was all but ignored in the education of the period, which remained for the most part medieval. The quiet, sensitive country boy was uninterested, and sank to the bottom of the class.

According to his own account, Newton remained intellectually dormant until the day when he was kicked in the stomach by the school bully. Newton challenged him to a fight in the church yard. In the words of Newton's first biographer Conduitt, who recorded Newton's reminiscences: 'Isaac was not so lusty as his antagonist [but] he had so much more spirit and resolution that he beat him till he declared he would fight no more'. Newton had found a legitimate target on which to vent the dreadful anger that lay repressed within him. But once this was aroused it became uncontrollable, and then there was no holding him back. Trouncing his physically superior opponent was not enough. After his victory 'Isaac pulled him along by the ears and thrust his face against the side of the church and rub his nose against the wall'. But even such physical humiliation was not sufficient. Newton had to defeat his opponent in every way possible. He felt the need to better his opponent intellectually, began trying in class, and was soon demonstrating his intellectual superiority.

Once Newton's intellectual faculties had been roused, there was no stopping him. Watching the teenage dullard emerge from his chrysalis and stretch the butterfly wings of genius must have been a wondrous sight for the townsfolk of Grantham. And of course they all remembered it. In hindsight. According to reminiscences collected after the death of the great Sir Isaac Newton, President of the Royal Society, Master of The Royal Mint etc, young Isaac displayed all the expected signs of supreme genius - baffling the locals with intricately constructed model windmills, hand-made water clocks, exploding kites, a mouse-driven corn mill, a foldable paper lantern, his ability to tell the precise time from a shadow, and a notebook filled with the usual unintelligible diagrams. Fortunately this notebook is now in the Pierpont Morgan Library in New York, an inscription inside the front cover recording that it was originally bought by Newton for 2½ d (old pennies) in 1659. Its contents confirm the seemingly fanciful memories of the people of Grantham, with pages containing diagrams of Copernicus' solar system, details of how to make a sundial and construct a model windmill, and astronomical predictions of eclipses. Two things are obvious. Newton's intellectual interests had expanded far beyond the limits of his school education. And his main interest was in science and how things worked.

All the evidence points to a precociously brilliant, largely self-taught amateur. Unusual, but not unique. There must have been a score or more of similar prodigies throughout the land. Like the great majority of the others, Newton seemed destined to eccentric provincial mediocrity. In the same year as he bought his tu'penny ha'penny notebook, his mother called him home to run the farm. He was just 17.

But this time all was not sweetness and light at home. Newton's mind was now afire with something more absorbing. Psychological explanations of Newton's sudden all-consuming obsession with science abound - from discovering Father's clues, to a demented need for escape into an ordered world free from psychic anxiety. But one thing is certain, this overwhelming interest in science gripped Newton's adolescent mind with the force of an addiction. (And was to retain such force, virtually without ceasing, for 37 years.)

As a farmer, the 17-year-old Newton was worse than useless. Set to watch over the sheep, he would settle in the shade of a tree with a book. When he went to market in Grantham, he left the farmhand to sell the produce and livestock while he nipped round to the house of his former landlord Mr. Clark to pick up some more books (one of Mr. Clark's relatives had left his collection in the attic). The sheep broke loose over the hills, the pigs overran the neighbor's cornfields, and the boundary fences fell into an illegal state of disrepair. As a result Newton was hauled before the courts and fined four shillings and four pennies. (The cost of a good pair of shoes.) Newton's first official qualification was a criminal record.

Mother had no idea what to do, and life at home was fraught. Like most teenagers, he knew what he didn't want to do. Unlike most teenagers, he knew precisely what he did want to do. Newton continued reading avidly, making models, conducting scientific experiments, calculating and sketching diagrams in his notebook.

Fortunately two people had recognized Newton's exceptional talents. One was John Stokes, his schoolmaster at Grantham; the other was his maternal uncle William Ayscough, rector of the nearby village of Burton Coggles, who happened to be a graduate of Trinity College, Cambridge. Between them, they managed to persuade Newton's mother to send him back to school in Grantham, where Stokes could prepare him for entrance to Trinity College, Cambridge.

Newton returned to live with Mr. Clark the apothecary, where he continued to devour the collection of books, and now began decorating his room with all kinds of drawings.

*to be continued...*

Name: \_\_\_\_\_

Period: \_\_\_\_\_ Table: \_\_\_\_\_

General Physics  
Newton & Gravity  
Intro & Childhood  
Vocabulary



**vouchsafed -**

**gravitas -**



**revered -**

**austere -**

**façade -**

**vindictive -**



**predecessor -**

**impecunious -**

**frugal -**

**traumatic -**

**indelible -**

**paranoid -**



**repressed -**

**unalloyed -**

**Parliamentarians -**

**repressive -**

**Puritanism -**

**precocious -**

**apothecary -**

**medieval -**

**dormant -**



**reminiscences -**

**roused -**

**dullard -**

**chrysalis -**

**prodigies -**

**eccentric -**

**provincial -**

**mediocrity -**

**demented -**

**nipped -**



**shillings -**

**fraught -**

**avidly -**

**devour -**